



## Applications Note 611 How Do You Determine Cold Junction Error In A Thermocouple System?

### Q: How do you determine Cold Junction Error in a Thermocouple System?

**Answer:** If we ignore the error in the thermocouple itself, the primary instrument error in a TC system is made up of three parts:

- Cold Junction Error
- Gain Error
- Linearization Error

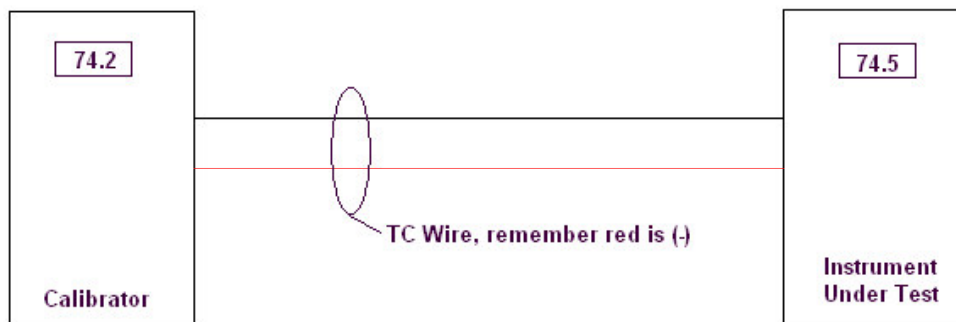
In this App Note we will only talk about **Cold Junction Error**. We will talk about others in future app notes.

A TC is basically a differential temperature measuring device. It measures the difference in temperature between its two ends<sup>1</sup>. Thus in order to measure the Hot Junction end, you must know the temperature of the Cold Junction (CJ) end. If you are going to calibrate the device (or even just test it) you must set up the CJ before you can proceed to the TC calibration stage. (Note that CJ and zero interact with each other, so if there is a separate zero you must set it first.) We will assume that you have set the zero, or it is a part of the cold junction's calibration.

In order to measure the cold junction without interacting with the other system errors, we want to minimize the differential temperature. This means applying a signal as close to zero as possible. In TC land, that means room temperature. This effectively eliminates all gain errors, and the majority of the linearization errors.

This is the procedure:

1. Connect a TC calibrator to the instrument with the appropriate TC wire.
2. Set the TC calibrator to room temperature. This effectively eliminates the error caused by the TC wire, and any gain errors and minimizes linearization errors in the system.
3. Note the temperature of the Calibrator and the Temperature displayed on the instrument.
4. If you are calibrating, calibrate to minimize the difference. If you are testing, the difference is the CJ error.



The CJ error is the difference between the two temperatures.  
In this case is 0.3°F

Other Applications Notes: [www.AdvIndSys.com/ApplicationsNotes.htm](http://www.AdvIndSys.com/ApplicationsNotes.htm)

<sup>1</sup> For those of you that are purists, the temperature difference that is measured by the TC is also a factor of the absolute temperature of the Hot Junction. We are ignoring that factor in this App Note for clarity.